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NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
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in its capacity as elected Office

Date of mailing: 20 April 2000 (20.04.00)	
International application No.: PCT/GB99/03347	Applicant's or agent's file reference: A25692 WO
International filing date: 08 October 1999 (08.10.99)	Priority date: 14 October 1998 (14.10.98)
Applicant: BEDDUS, Simon, Alexander et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International preliminary Examining Authority on:

07 February 2000 (07.02.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was
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PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference A25692 WO	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/GB99/03347	International filing date *(day/month/year)* 08/10/1999	Priority date *(day/month/year)* 14/10/1998
International Patent Classification (IPC) or national classification and IPC H04Q3/00		
Applicant BRITISH TELECOMMUNICATIONS PUBLIC LTD ...et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 8 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

   I ☒ Basis of the report
   II ☐ Priority
   III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   IV ☐ Lack of unity of invention
   V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   VI ☐ Certain documents cited
   VII ☒ Certain defects in the international application
   VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
07/02/2000	08.12.2000
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Kreppel, J Telephone No. +49 89 2399 8246

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).)*:

Description, pages:

1-12 as originally filed

Claims, No.:

1-21 as originally filed

Drawings, sheets:

1/14-14/14 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-9,11,12,14-21
	No:	Claims	10,13
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-21
Industrial applicability (IA)	Yes:	Claims	1-21
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

With respect to section V:

1 The following documents (D) are referred to in this communication; the numbering will be adhered to in the rest of the procedure:

D1: WO 96 42173 A (BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY) 27 December 1996 (1996-12-27)
D2: US 4 800 488 (RAKESH AGRAWAL ET AL) 24 January 1989 (1989-01-24)

2 Document **D1** which is regarded as representing the closest prior art to the subject-matter of **claim 1** discloses a communications service platform comprising a number of general purpose computers which are coupled via a data communications network and may be widely distributed. According to Figure 3 of D1 (cp. page 3, line 16 to page 4, line 32), each of the computers comprises service resources which are registered by a location function when the resources are instantiated in one of the computer systrems. The location function routes arriving service requests afterwards to the respective computer comprising the resource.

Hence, document D1 discloses according to features of claim 1, a communications service platform (Fig. 3: 22; page 1, line 32 to page 2, line 2) comprising
a multiplicity of loosely coupled subsystems, each of the subsystems including
respective service processing resources (Fig. 3: 223; page 3, line 27 to 31); and
a respective resource locator (Fig. 3: 40; page 4, lines 18 to 32), the resource locator including means for receiving identity data and resource availability data (Fig. 3: 44; page 13, line 20 to 25).

The communications service platform which is subject-matter of present claim 1 differs from that known platform in that the respective resource locators include means for communicating to others of the resource locators data indicating the subsystems identity and data indicating the availability of resources in the respective subsystems.

Location of resources is thus handled in a decentralized way whereby the computer systems are exchanging messages to register available service resources. Using this feature, no central resource location function will be needed.

Document **D2** which has not been cited in the international search report (a copy of the document is hereby appended) discloses a computer network, each computer comprising various resources and a server database indicating the availability of resources provided by other computer systems. The availability of resources is indicated by the computer comprising the resource by sending an advertisement message to other computers (col. 1, lines 6 to 11; col. 2, line 18 to col. 3, line 57).

Hence, it would be obvious to the person skilled in the art in order to provide a decentralized resource location mechanism, to apply these features with corresponding effect to a communications service platform according to document D1, thereby arriving at a communications service platform according to claim 1.

The subject-matter of claim 1 does therefore not involve an inventive step (Article 33(3) PCT).

3 Document **D1** is regarded as representing the closest prior art to the subject-matter of independent **claim 10**. It discloses, according to the features of claim 10, a communications system (page 1, lines 3 to 4) comprising:

- a plurality of call processing subsystems (page 1, line 28 to page 2, line 13);
- a network interconnecting the plurality of call processing subsystems (page 3, lines 20 to 21);
- a resource broker connected to the network, the resource broker including a data interface arranged to receive capability data and interface data from respective call processing subsystems (page 4, lines 18 to 32), and

Document D1 also implicitly discloses a registry arranged to store the said capability data and interface data because the location broker must comprise a database or the like to store the available resources and locations respectively (page 13, lines 20 to 25).

D1 thus discloses all the features of claim 10. The subject-matter of claim 10 is therefore not novel (Article 33(2) PCT).

Even if the applicant would argue that the subject-matter of claim 10 is novel due to minor differences to the features disclosed in D1, it could however not be considered as inventive because the differences would be too minor to justify an inventive step.

4 Document **D2** which is considered as representing the closest prior art to the subject-matter of **claim 13** discloses, according to the features of claim 13, a computing platform comprising a multiplicity of loosely coupled subsystems (col. 1, lines 6 to 11), each of the subsystems including respective data processing resources (col. 2, lines 44 to 51) and a respective resource locator arranged to advertise its identity and the loading of the respective resources and to receive resource signaling from others of the resource locators (col. 2, lines 33 to 36; col. 2, line 52 to col. 3, line 2).

The subject-matter of claim 13 is therefore not novel (Article 33(2) PCT).

5 Independent **claim 14** relates to a method of operating a communications system. The method comprises the same combination of features as system claim 1 in form of method features. The same arguments as for claim 1 apply therefore also for claim 14, i.e. the subject-matter of claim 14 is rendered obvious by a combination of the method of operating a communications system according to document D1 and the method of propagating resource information in a computer network disclosed by D2.

6 Dependent **claims 2 to 9, 11, 12 and 15 to 21** do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty or inventive step, because they are either known from documents D1 and D2 or represent, respectively, merely one of several straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill, in order to solve the respective problem posed.

6.1 The subject-matter of dependent **claim 2** is already disclosed in D2 (col. 2, line 18 to col. 3, line 57).

6.2 Dependent **claims 3 to 5 and 19** relate to a resource broker mediating the communication between the resource locators. These features are already disclosed in D1 (page 4, lines 18 to 32; page 13, line 20 to 32).

6.3 Dependent **claims 6 to 9** relate to miscellaneous configurations of the communications service platform where the location function is partly handled in a decentralized way by peer-to-peer signaling between the subsystems and partly mediated by the resource broker. The claims include merely combinations of the features of centralized or decentralized resource location disclosed either in D1 or D2, respectiveley, and are therefore lying within the design competence of a person skilled in the art.

6.4 Dependent **claims 11, 12, 20 and 21** relate to obvious implementation alternatives for interconnecting the processing subsystems.

6.5 Dependent **claims 15 to 18** relate to obvious implementation alternatives for controlling and triggering the messages indicating the availability of resources.

6.6 The subject-matters of dependent **claims 2 to 9, 11, 12 and 15 to 21** do therefore not involve an inventive step (Article 33(3) PCT).

With respect to section VII:

1 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1 and D2 is not mentioned in the description, nor are these documents identified therein.

2 Page 14, last line: the parenthesis is apparently superfluous.

With respect to section VIII:

Claim 18 does not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined. It is not clear how a change in resource availability can exceed a threshold.

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PROCESSING PLATFORM

The present invention relates to a processing platform and particularly to telecommunications service platform using a number of loosely coupled subsystems.

Platforms used, for example, to implement advanced services in a telecommunications network having an IN (intelligent network) architecture, may comprise a number of loosely coupled subsystems linked by a high speed network. This structure enhances the capacity and the resilience of the platform. The resources of the platform are managed by a centralised management system that is responsible for allocating particular resources to given call and for reconfiguring the system, for example, in the event of one of the system components failing. As conventionally implemented, such a platform suffers the disadvantages of having a high management overhead and having poor scalability, that is, the platform is not readily adaptable to provide increased capacity.

According to a first aspect of the present invention, there is provided a communications service platform comprising a multiplicity of loosely coupled subsystems, each of the subsystems including respective service processing resources and a respective resource locator, each resource locator including means for communicating to others of the resource locators its identity and the availability of the resources in the respective subsystem, and means for receiving identity data and resource availability data for resource locators in others of the subsystems.

This aspect of the invention provides a service platform which maintains the resilience and capacity of a distributed processing architecture while reducing the management overheads and providing greatly improved scalability. This is achieved by providing each subsystem with a resource locator which advertises the resources of the relevant subsystem and also listens to information from other subsystem. In this way the task of resource management and allocation is distributed between the subsystems, and the system as a whole is provided with a mechanism for recognising and responding to the addition of new subsystems.

The resource locators may be arranged to communicate directly by peer-to-peer signalling. Preferably, however, the platform includes a resource broker and communication between the resource locators is mediated by the resource

broker. The resource broker may be located in one of the service processing subsystems, or may be located in a dedicated platform. The resource broker may include a data interface arranged to receive capability data and interface data from respective resource locators, and a registry arranged to store the said capability data and interface data. Preferably a resource locator in a subsystem is arranged initially to read capability data and interface data for another subsystem from the resource broker, and subsequently communicates further data directly with the other subsystem using the interface of the subsystem identified in the said interface data.

The system developed by the present inventors is not limited to use in communications systems but may also be used in a general computing environment.

According to a second aspect of the present invention there is provided a computing platform comprising a multiplicity of loosely coupled computing subsystems, each of the said subsystems including respective data processing resources and a respective resource locator arranged to advertise its identity and the loading of the respective resources and to receive resource signalling from others of the resource locators .

According to a third aspect of the present invention, there is provided a method of operating a communications system, the system including a multiplicity of processing subsystems and a network interconnecting the multiplicity of subsystems, the method comprising;

a) communicating from a resource locator in a respective one of the multiplicity of subsystems to resource locators in others of the multiplicity of subsystems data indicating the identity of the said one subsystem and the availability of resources in the said one subsystem

b) repeating step (a) for each other of the multiplicity of subsystems:

c) when one of the multiplicity of subsystems, in the course of processing a call, requires resources not present locally in the said subsystem:

i) identifying from the said data communicated to the resource locator of the said one subsystem another subsystem having the said resources;

ii) accessing the said subsystem via the network.

According to a fourth aspect of the present invention, there is provided a communications system comprising:

a plurality of call processing subsystems;

a network interconnecting the plurality of call processing subsystems;

a resource broker connected to the network, the resource broker including

a data interface arranged to receive capability data and interface data from respective call processing subsystems, and

a registry arranged to store the said capability data and interface data.

The term "call processing subsystem" is used here broadly to encompass systems ancillary to the processing of a call, such as, e.g., an Email server, a mobility application platform or an interactive voice response (IVR) platform, as well as systems, such as a communications server, which are directly involved in the handling of a call.

Systems embodying the present invention will now be described in further detail, by way of example only, with reference to the accompanying drawings in which;

Figure 1 is a schematic of network embodying the invention;

Figure 2 is a diagram showing the structure of a service control point in Figure 1;

Figure 3 is a schematic of a network employing peer-to-peer signalling:

Figure 4 is a schematic of a network employing a broker;

Figure 5 is a diagram showing interactions between a broker and components;

Figure 6 is a schematic showing an architecture implementing the invention;

Figure 7 is a class diagram for an implementation of the architecture of Figure 6;

Figure 8 is a message flow diagram showing a first scenario;

Figure 9 is a message flow diagram showing a second scenario;

Figure 10 is a schematic of an implementation of the architecture of Figure 6 across different networks;

Figure 11 is a diagram illustrating different interface types in a system embodying the invention;

Figure 12 is a diagram showing the structure of a resource broker;

Figure 13 shows a system in which components incorporate both type 1.0 and type 2.0 interfaces

Figure 14 shows a personal mobility service implemented using the architecture of Figure 6.

A telecommunications network which uses an IN (Intelligent Network) architecture includes a service control point 1, which is also termed herein the Network Intelligence Platform (NIP). The service control point 1 is connected to trunk digital main switching units (DMSU's) 2 ,3 and to digital local exchanges (DLE's) 4,5. Both the DMSU's and the DLE's function as service switching points (SSP's). At certain points during the progress of a call, the SSP's transfer control of the call to the service control point. The service control point 1 carries out functions such as number translation and provides a gateway to additional resources such as a voice messaging platform. The network also includes a second service control point 6, which in this example runs customer mobility applications. The two service control points are connected to each other and to the other components via a broadband signalling network 7.

Figure 2 shows the structure of the service control point 1. A service management server is connected via an FDDI optical fibre LAN 21 to an overload control server (OCS) and to transaction servers (TS). The overload control server monitors call rates and initiates action to protect the SCP and other elements of the network from overload. For example the OCS may send a call-gapping instruction to an originating exchange. Additionally or alternatively, a call-gapping instruction may be sent to the broker, so that the broker rations the availability, e.g., of switching resources at the originating exchange so as to protect other resources downstream of the originating exchange. The transaction servers implement advanced service control functions such as, for example number translation and call plans. The OCS and transaction servers are connected via a second FDDI LAN 22 to communications servers (CS) which are connected to an SS7 (ITU Signalling System no. 7) signalling network. A global data server (GDS) is also connected to this second LAN. The GDS records call statistics and may also be used in the operation of overload control functions.

Figure 3 is a simplified schematic of the network of Figure 1, illustrating a first implementation of the present invention. The Figure shows a first SCP 31, a second SCP 32 and a DMSU 33. These components constitute loosely coupled subsystems of a platform which runs one or more IN services. The subsystems are connected by a broadband signalling network 34, for example an FDDI LAN. As indicated by the key to the Figure, each subsystem includes call processing resources of different types and also a resource locator 35. The first SCP includes resource types 1 and 2 which might correspond, for example, to a VPN (virtual private network) control function and to a number translation function respectively. The second SCP includes type 1 resources, and the DMSU includes resource type 3, for example a call switching function. Each locator advertises to all other locators, the identity and location of the subsystem, the resources available at that location and, for example, the loading of the resources. For example the locator in the first SCP 31, when the SCP is initiated, broadcasts to the other resource locators, a message in the form (SCP1; address1; type 1, 50%; type 2, 90%) where the first field is the identity, the second field is the address, and the subsequent fields are resource types and include a measure of resource loading. This message is received and stored by the resource locators in the other subsystems, and they in turn broadcast resource messages which are received by the resource locator in the SCP 31. The step of broadcasting resource messages is repeated periodically, with a frequency chosen to balance the need of the system to re-balance resources after a subsystem failure, or after incremental changes in the proportion of free resources in a subsystem, against the need to minimise signalling overheads. In the present example, resource locators re-transmit a resource message every 10 seconds. Then, for example, if a call originating at the DMSU is making use of VPN resources in the first SCP, and the first SCP fails, the failure will become apparent within, at most 10 seconds, and the DMSU resource locator may identify alternative resources in the second SCP. The absence of an expected update is interpreted by the resource locators as an indication that the corresponding resources have become unavailable. In addition, subsystems may update the resource locators in response to events within that subsystem. For example, a subsystem may be programmed to update the resource locators whenever its loading changes by more than a predetermined threshold, e.g. 20%.

Figure 4 is a schematic illustrating a second implementation of the invention. In this example, in addition to the first and second SCP's and the DMSU described above with reference to Figure 3, the system also includes a resource broker 40. The resource broker includes, in addition to its own resource locator 41, a data store 42 which holds a registry of data communicated by other subsystems, and an authentication processor 43 which authenticates data received from the subsystems prior to entering the data in the registry. The broker may be implemented on a commercially available system such as that available from Visigenics as the Visigenics ORB (object request broker) running, for example, on a Digital SPARC Ultra (trademark) workstation. As shown in Figure 5, a subsystem, here termed a "component", must first authenticate itself with the broker, for example using a password or a digital signature, and agree a security mechanism for further exchanges. The component then registers its interfaces with the broker. For example, a communications server might register an INAP communications channel at a specified network address. From this point, the component can discover the interfaces of other components within the system by reference to the registry in the broker. Once the component understands the interfaces of other components it can communicate freely with the other components without further reference to the broker.

Figure 12 shows in further detail the structure of the resource broker 40. It comprises a resource registry, a service registry, and modules for authentication, registration and discovery. Tables 1 and 2 below show examples of the contents of the resource registry and service registry respectively. Each resource in the resource registry may have linked with it a number of entries in the service registry.

TABLE 1

Name: Athena
Processor: Digital SPARC Ultra
Address: 132.14.32.71
Function: Call Control Server

TABLE 2

Call Control:INAP

no. RANGE 64XXXX-67XXXX
Network Operator: BT
Capacity: 100 cps
Security parameters:
authentication level
signature
Interface: VIPER 1.0

Figure 6 shows an overview of an architecture that is implemented using a resource broker as described above with reference to Figures 4 and 5. The broker and the network used by the subsystems to communicate with the broker together provide a brokered environment 60. In this example, the subsystems connected to the brokered environment 60 include a PSTN network 61, a gatekeeper 62 for voice over IP (internet protocol) services, fax resources 63, an Email server 64 and a voice mail server 65 . A number of applications use the resources of the subsystems 61-65. These applications locate the appropriate resources using the resource broker contained within the brokered environment 60. This implementation is termed by the inventors the "VIPER" architecture. The architecture provides for two types of interfaces, termed by the inventors VIPER 1.0 and VIPER 2.0. As illustrated in Figure 11, VIPER 2.0 interfaces provide for communication between subsystems via an object bus 110. Subsystems using VIPER 2 interfaces request resources from a resource broker on a per call basis and communicate using, e.g., the CORBA protocol. VIPER 1 interfaces bypass the object bus and use specific protocols such as INAP to communicate with other systems. Subsystems with VIPER 1 interfaces register and discover resources and interface details with the resource broker when the subsystem is initialised, but do not communicate with the resource broker for subsequent calls. Such subsystems using VIPER 1 interfaces then communicate with other subsystem using protocols specific to the subsystem, for example INAP in the case of a communications server communicating with a transaction server.

In operation, a subsystem such as a communications server may initially download copies of service and resource registry data from the resource broker to form a locally cached copy of the resource broker. For example, in Figure 11, the

communications server CS may optionally include a locally cached broker (LCB), as shown in dashed lines in the Figure. Then discovery operations may be carried out using the locally cached copy of the resource broker. In this case, even where a VIPER 2.0 interface is used, it is not necessary for signalling to pass between the communications server and the remote broker on every call. Instead, data passes between the remote broker and the communications server only intermittently when it is necessary to refresh the locally cached resource broker. Although the communications server, if it employs a VIPER 2.0 interface, still interrogates the resource broker for each new call, it is in general the locally cached broker that is used for this purpose.

Figure 7 is a class diagram showing an implementation of the architecture of Figure 6. This diagram is generated using the Rational ROSE software engineering tool and provides a basis, using that tool, for generating, e.g., Java code implementing the invention. Rational ROSE is available commercially from Rational Software Corporation. In this implementation, the subsystems that interact using the broker are termed "plugins".

Figure 8 shows a network operator bringing a VIPER broker, a VIPER Cambridge Transaction Server and a VIPER Cambridge Communications Server into service. "Cambridge" is the name given to the SCP illustrated in Figure 2. After registration and discovery is complete, an incoming call triggers an INAP (Intelligent Network Application Protocol) IDP (initial detection point) at a DLE. The DLE is referenced GPT_SSP in the diagram. The call is cut-through the VIPER middleware. Since the communications server CS and transaction server TS have both registered VIPER 1.0 interfaces with the resource broker, the CS does not have to ask the broker each time a call is received for the address of a suitable service resource or "plugin". Instead the CS and TS communicate directly using an INAP interface and bypassing the object bus. After location lookup is performed, an INAP connect is also cut-through the VIPER middleware back to the SSP. The following events and messages are shown in Figure 8:

1: Network operator brings the VIPER broker into service.

2: VIPER broker registers it services with itself if necessary.

3: Network operator brings the VIPER Cambridge Transaction Server into service.

4: VIPER Cambridge Transaction Server registers itself as a PlugIN with the VIPER broker.

5: VIPER Cambridge Transaction Server registers the services it supports with the VIPER broker.

6: Network operator brings the VIPER Cambridge Communications Server into service.

7: VIPER Cambridge Communications Server registers itself as a PlugIN with the VIPER broker.

8: VIPER Cambridge Communications Server registers the services it supports with the VIPER broker.

9. VIPER Cambridge Transaction Server requests the address of the PlugIN associated with 'name' (in this case, VIPER Cambridge Communications Server).

10. VIPER Cambridge Communications Server requests the address of the PlugIN associated with 'name' (in this case, VIPER Cambridge Transaction Server).

11. GPT SSP sends an INAP Initial Detection Point (IDP) to the VIPER Cambridge Communications Server.

12. VIPER Cambridge Communications Server sends a INAP IDP to the VIPER Cambridge Transaction Server.

13. VIPER Cambridge Transaction Server does an internal location lookup, then sends an INAP connect to the VIPER Cambridge Communications Server.

14. VIPER Cambridge Communications Server sends an INAP connect to the GPT SSP.

Figure 9 shows the message flows involved in a second scenario, with a network operator bringing a VIPER broker, a VIPER Mobility Server and a VIPER Cambridge Communications Server into service. The VIPER mobility server may be, for example, the SCP 6 running a mobility application illustrated in Figure 1. Once registration is complete, an incoming call triggers an INAP IDP into the VIPER middleware. A communications server CS creates a call model (labelled "INAP call" in Figure 9) and passes control of the service to that call model. The call model communicates with the resource broker to identify an application that is capable and ready to provide the resources required by the service. That application, if not already running, is created. The call model then request the application, in relation to this call, to perform a location look-up for the called party. On completion of the look-up, a mobile address returned by the look-up is passed to the communications server and the VIPER middleware send an INAP connect to the SSP.

1: Network operator brings the VIPER broker into service.

2: VIPER broker registers it services with itself if necessary.

3: Network operator brings the VIPER Mobility Server into service.

4: VIPER Mobility Server registers itself as a PlugIN with the VIPER broker.

5: VIPER Mobility Server registers the services it supports with the VIPER broker.

6: Network operator brings the VIPER Cambridge Communications Server into service.

7: VIPER Cambridge Communications Server registers itself as a PlugIN with the VIPER broker.

8: VIPER Cambridge Communications Server registers the services it supports with the VIPER broker.

9. GPT SSP sends an INAP Initial Detection Point (IDP) to the VIPER Cambridge Communications Server.

10 & 11. The VIPER Cambridge Communications Server creates a new call model to handle this service and then initiates the Call Model's constructor.

12. The Call Model requests from the VIPER broker the address of the PlugIN (in this case, the VIPER Mobility Server) capable of providing the service described within the service descriptor.

13, 14 & 15. The Call Model requests from the VIPER Mobility Server the address of the application capable of servicing the request. This causes the VIPER Mobility Server to create a Roaming Application and then initiate the Roaming Application's constructor. Flow 14 is optional depending on whether the Roaming Application is active or not.

16. The Call Model sends a VIPER 2.0 equivalent of an INAP IDP to the Roaming Application.

17. The Roaming Application performs a location lookup.

18. The Roaming Application sends a VIPER 2.0 Connect to the Call Model.

19. The Call Model sends an internal PlugIN connect to the VIPER Cambridge Communications Server.

20. The VIPER Cambridge Communications Server send an INAP connect to the GPT SSP.

Figure 10 illustrates an implementation of the VIPER architecture which provides a service platform which is distributed over different networks that may be located in different continents. In this example a customer at a customer

terminal 100 is registered with a mobility application resident on a first application server connected to a first broadband signalling network e.g. in the UK. The customer terminal is connected via a digital local exchange DLE to a second broadband signalling network, e.g., in the US. The first and second national networks are interconnected via a jointly operated international network 103. Resource brokers (referenced B) are connected to the networks and the resources available on each network are registered with the resource brokers. The resource brokers communicate data to each other via a global broker GB, so that, for example, the broker B connected to network 102 has in its registry details of resources on both network 101 and network 102. The communication between brokers may be implemented, e.g., using CORBA or IIOP over IP.

In operation, the customer at terminal 100 registers their current location with the mobility application on the first application server. To do this, they dial the number associated with the service. This triggers an IDP at the SSP. The SSP requests from a local broker B the address of the application required to service the call. The local broker B communicates with the global broker GB connected to network 103 to obtain interface and address data to allow the SCP to communicate with application server 1. The mobility application may, for example, require the use of an interactive voice response (IVR) system to accept data from the customer. This resource is provided within network 101 by a first intelligent peripheral IP1. However, the second network includes its own IVR resources provided by a second intelligent peripheral IP2. The mobility application requests discovery of IVR resources from the broker B. After communication with the global broker GB, the broker returns detail of the IP2 that is local to the customer at the current customer location. The application server 1 uses this information to return an INAP connect message to the SSP to set up a connection between the customer terminal and IP2.

CLAIMS

1. A communications service platform comprising:

a multiplicity of loosely coupled subsystems, each of the subsystems including

respective service processing resources; and

a respective resource locator, each resource locator including means for communicating to others of the resource locators data indicating the subsystem identity and data indicating the availability of resources in the respective subsystem, and means for receiving identity data and resource availability data for resource locators in others of the subsystems.

2. A platform according to claim 1, in which the resource locators are arranged to communicate directly with each other by peer-to-peer signalling.

3. A platform according to claim 1 or 2, further comprising a resource broker and in which at least some communication between the resource locators is mediated by the resource broker.

4. A platform according to claim 3, in which the resource broker is located in one of the said subsystems.

5. A platform according to claim 3 or 4, in which the resource broker includes:

a data interface arranged to receive capability data and interface data from respective resource locators, and

a registry arranged to store the said capability data and interface data

6. A platform according to any one of claims 3 to 5, in which a resource locator in a subsystem is arranged initially to read capability data and interface data for another subsystem from the resource broker, and subsequently communicates further data directly with the other subsystem using the interface of the subsystem identified in the said interface data.

7. A platform according to any one of claims 3 to 6, in which at least one of the subsystems is arranged to communicate directly with a selected other subsystem via a respective specific data interface and in which others of the subsystems are arranged to communicate with a selected other subsystem via an object bus.

8. A platform according to claim 7 in which the or each said subsystem arranged to communicate directly via a respective specific data interface is arranged, on initialisation of the said subsystem, to read data for the selected other subsystem from the resource broker, and in response to calls subsequent to the initialisation of the subsystem, communicates directly with the selected other subsystem without reference to the resource broker.

9. A platform according to claim 7 or 8, in which the said subsystems arranged to communicate via an object bus are arranged, in response to each new call, to read resource data from the resource broker.

10. A communications system comprising:

a plurality of call processing subsystems;

a network interconnecting the plurality of call processing subsystems;

a resource broker connected to the network, the resource broker including

a data interface arranged to receive capability data and interface data from respective call processing subsystems, and

a registry arranged to store the said capability data and interface data.

11. A communications system according to claim 10, further comprising an object bus interconnecting at least some of the call processing subsystems.

12. A communications system according to claim 11, in which communication paths between others of the subsystems bypass the object bus.

13. A computing platform comprising a multiplicity of loosely coupled computing subsystems, each of the said subsystems including respective data processing resources and a respective resource locator arranged (to advertise its identity and

the loading of the respective resources and to receive resource signalling from others of the resource locators .

14. A method of operating a communications system, the system including a multiplicity of processing subsystems and a network interconnecting the multiplicity of subsystems, the method comprising;

a) communicating from a resource locator in a respective one of the multiplicity of subsystems to resource locators in others of the multiplicity of subsystems data indicating the identity of the said one subsystem and the availability of resources in the said one subsystem

b) repeating step (a) for each other of the multiplicity of subsystems:

c) when one of the multiplicity of subsystems, in the course of processing a call, requires resources not present locally in the said subsystem:

i) identifying from the said data communicated to the resource locator of the said one subsystem another subsystem having the said resources;

ii) accessing the said subsystem via the network.

15. A method according to claim 14, in which, for each of the multiplicity of subsystems, step (a) is repeated regularly.

16. A method according to claim 15, in which the period of repetition for step (a) is small compared to the mean duration of a call processed by the communications system.

17. A method according to any one of claims 14 to 16, in which, for at least one of the multiplicity of subsystems, step (a) is repeated in response to an event in the respective subsystem.

18. A method according to claim 17, in which the said event is a change in resource availability in the subsystem exceeding a predetermined threshold.

19. A method according to any one of the preceding claims in which the communication of resource data between subsystems is mediated by a resource broker.

20. A method according to claim 19, in which data is communicated between at least some of the subsystems and the resource broker via an object bus.

21. A method according to claim 20 in which data is communicated between others of the subsystems directly, bypassing the object bus.

Fig.1.

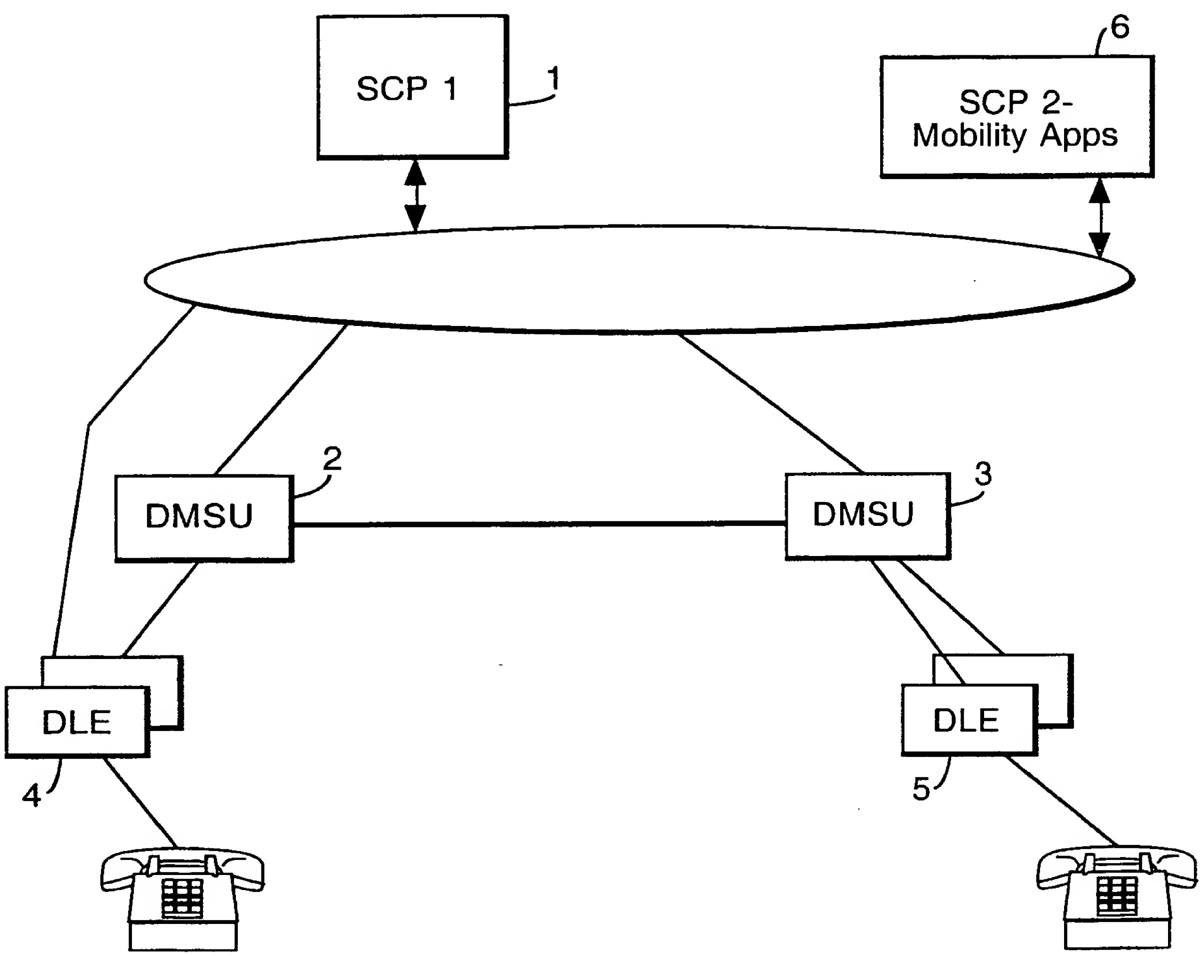


Fig.2.

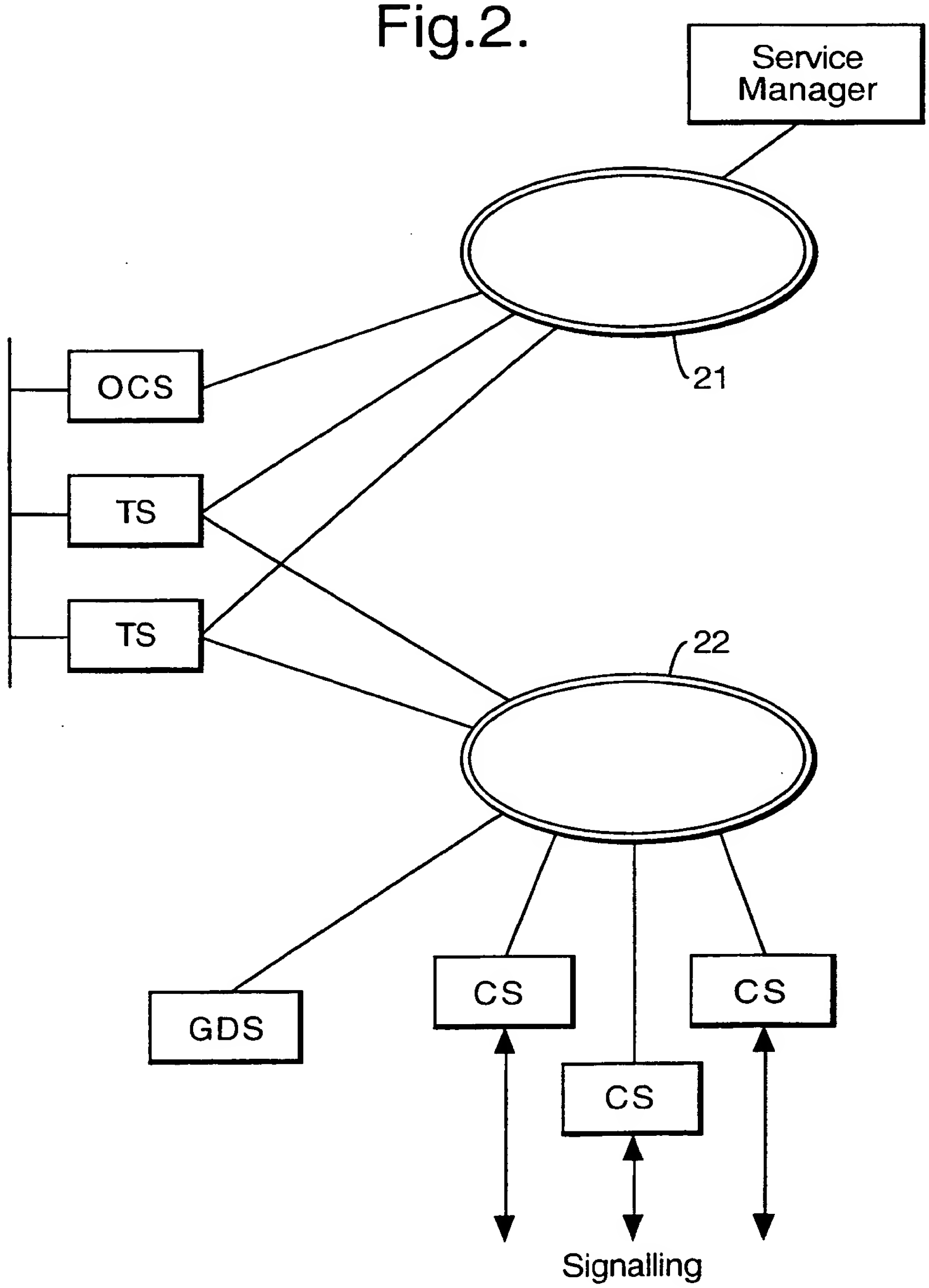


Fig.3.

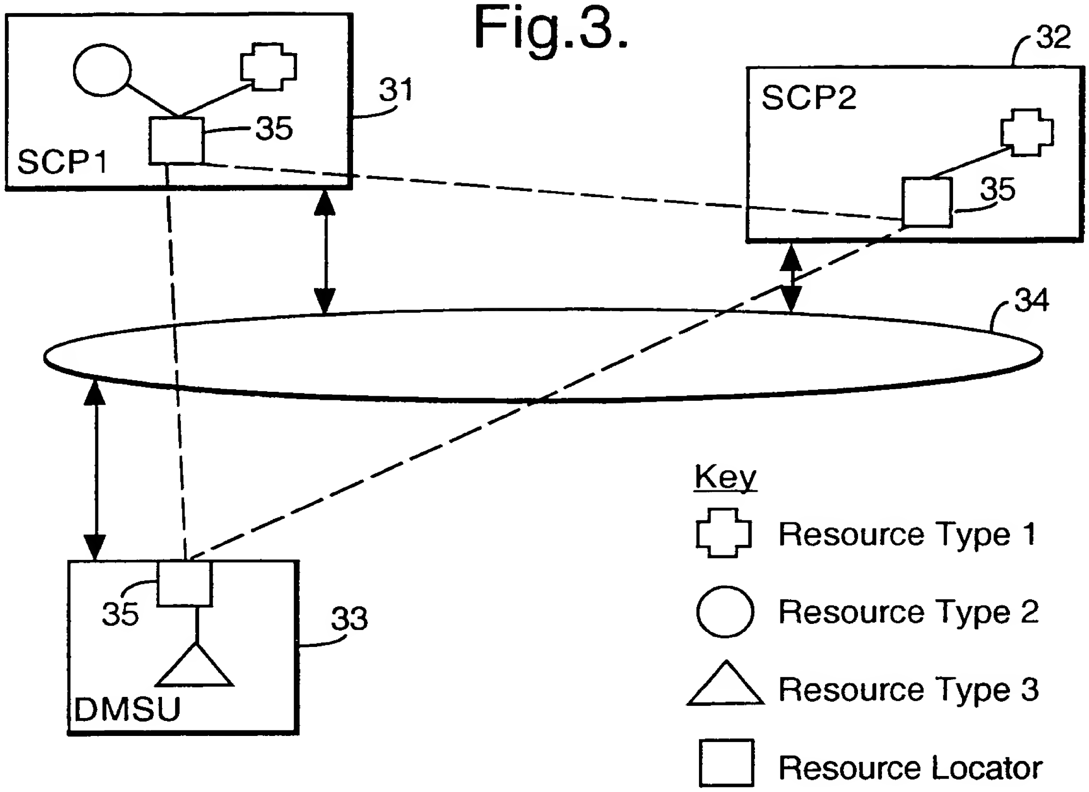

SCP1
31
35
SCP2
32
35
34
35
33
DMSU
Key
Resource Type 1
Resource Type 2
Resource Type 3
Resource Locator

Fig.4.

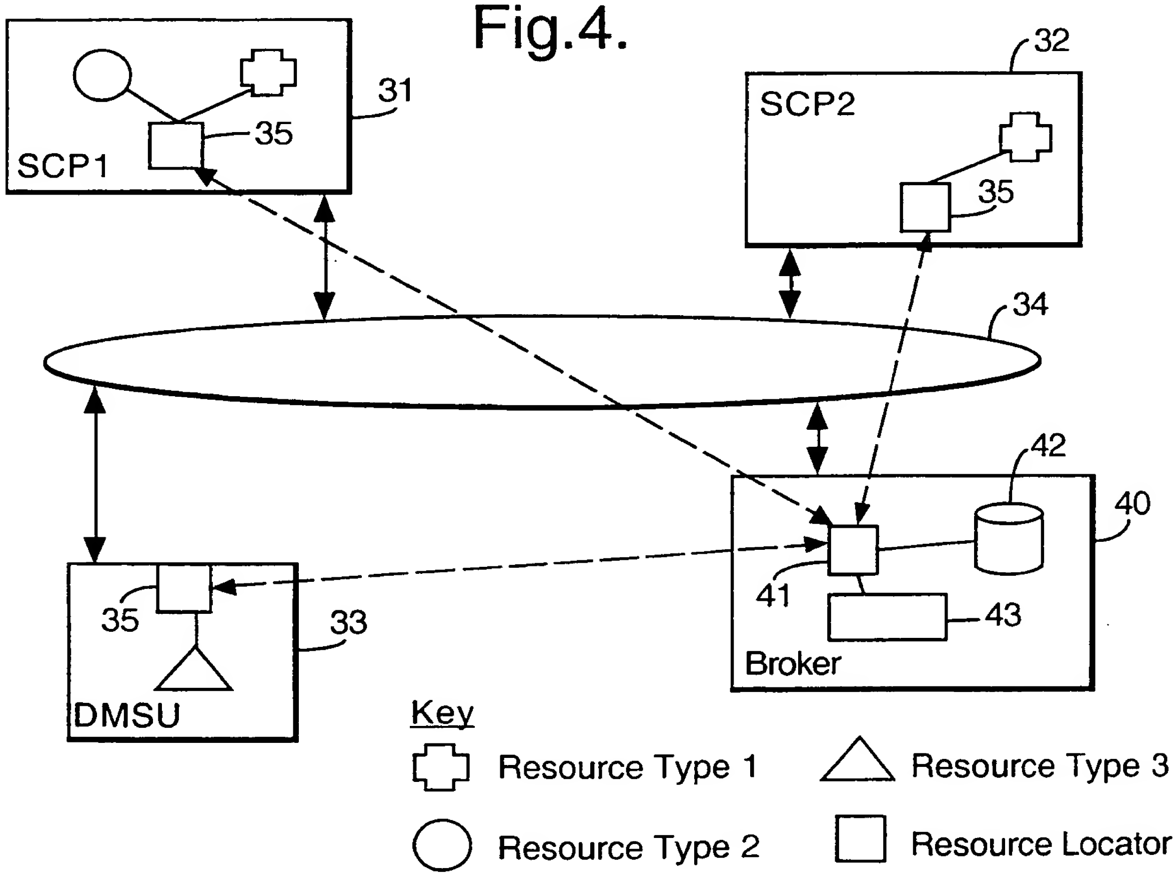

SCP1
31
35
SCP2
32
35
34
42
40
41
43
Broker
35
33
DMSU
Key
Resource Type 1
Resource Type 2
Resource Type 3
Resource Locator

Fig.5.

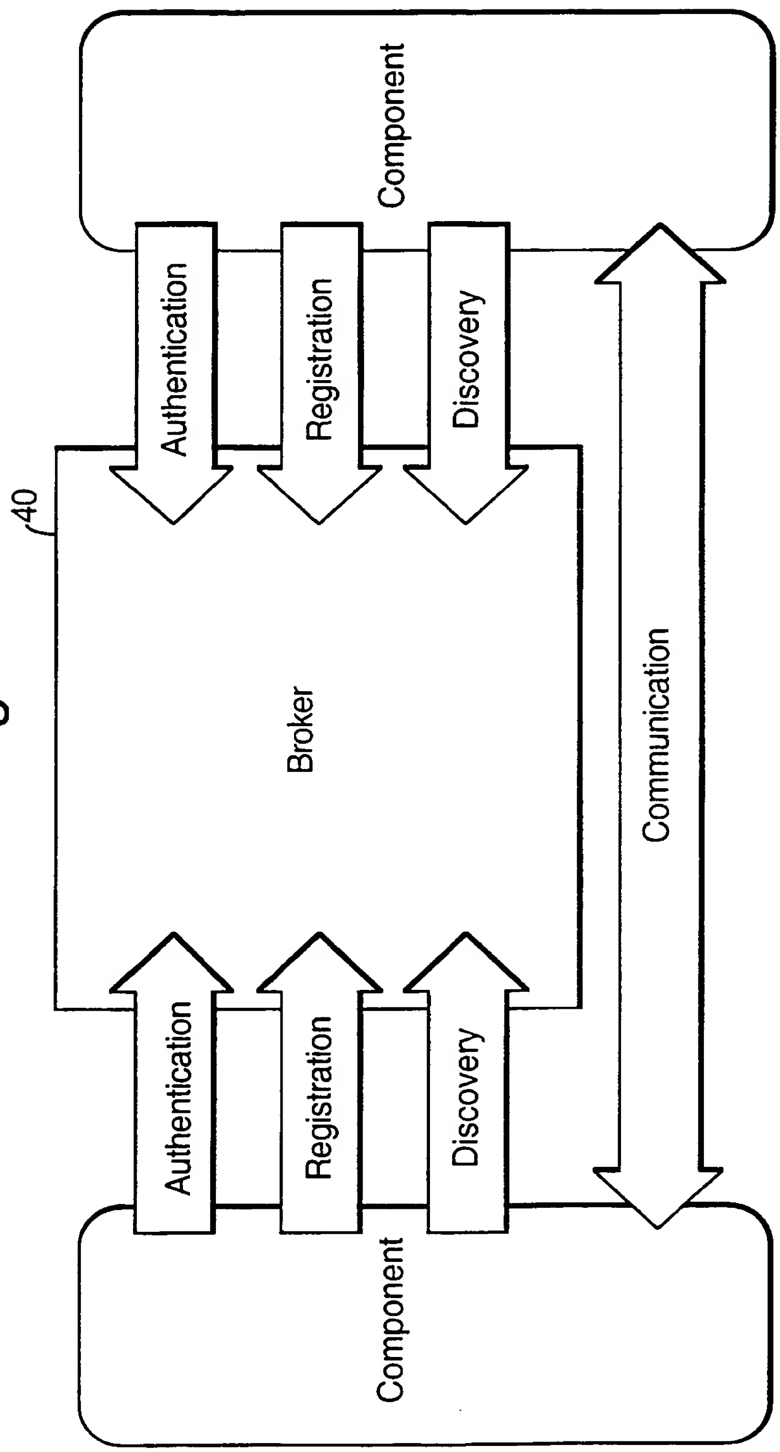

Component
Authentication
Registration
Discovery
40
Broker
Communication
Authentication
Registration
Discovery
Component

Fig.6.

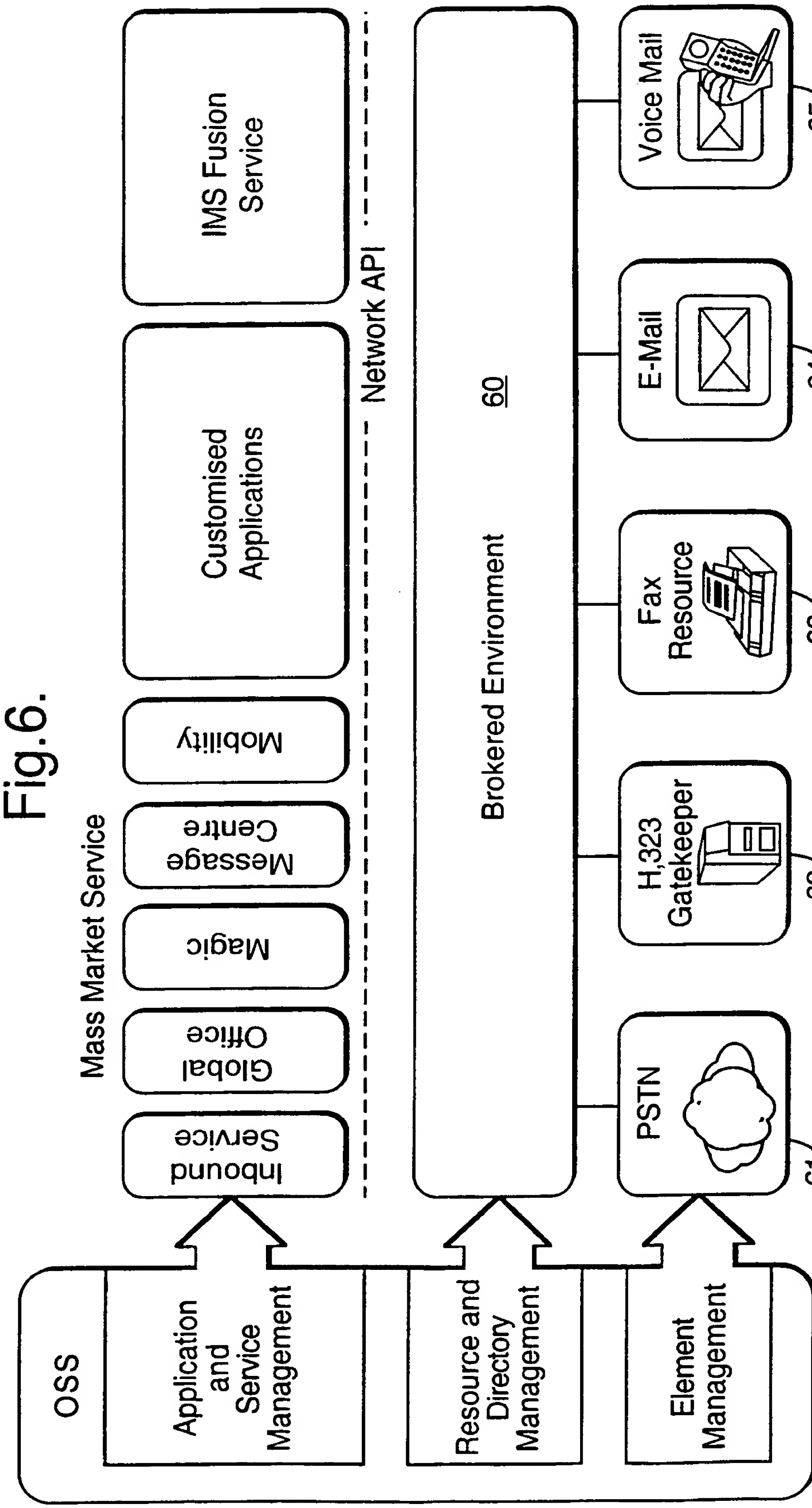

Mass Market Service
Inbound Service
Global Office
Magic
Message Centre
Mobility
Customised Applications
IMS Fusion Service
Network API
Brokered Environment 60
PSTN
61
H,323 Gatekeeper
62
Fax Resource
63
E-Mail
64
Voice Mail
65
OSS
Application and Service Management
Resource and Directory Management
Element Management

Fig.7.

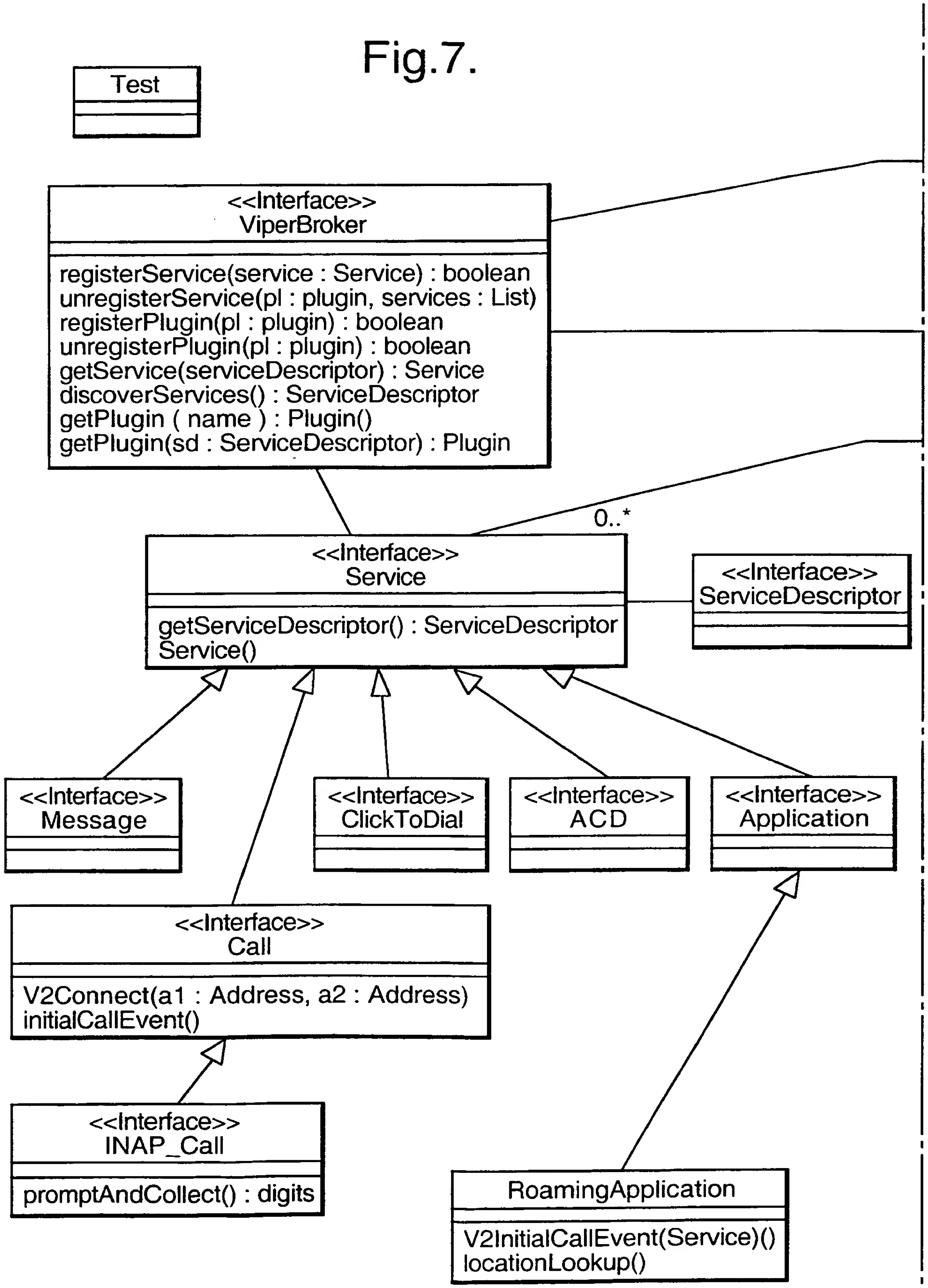

Test
<<Interface>>
ViperBroker
registerService(service : Service) : boolean
unregisterService(pl : plugin, services : List)
registerPlugin(pl : plugin) : boolean
unregisterPlugin(pl : plugin) : boolean
getService(serviceDescriptor) : Service
discoverServices() : ServiceDescriptor
getPlugin (name) : Plugin()
getPlugin(sd : ServiceDescriptor) : Plugin
0..*
<<Interface>>
Service
getServiceDescriptor() : ServiceDescriptor
Service()
<<Interface>>
ServiceDescriptor
<<Interface>>
Message
<<Interface>>
ClickToDial
<<Interface>>
ACD
<<Interface>>
Application
<<Interface>>
Call
V2Connect(a1 : Address, a2 : Address)
initialCallEvent()
<<Interface>>
INAP_Call
promptAndCollect() : digits
RoamingApplication
V2InitialCallEvent(Service)()
locationLookup()

Fig.7 (Cont).

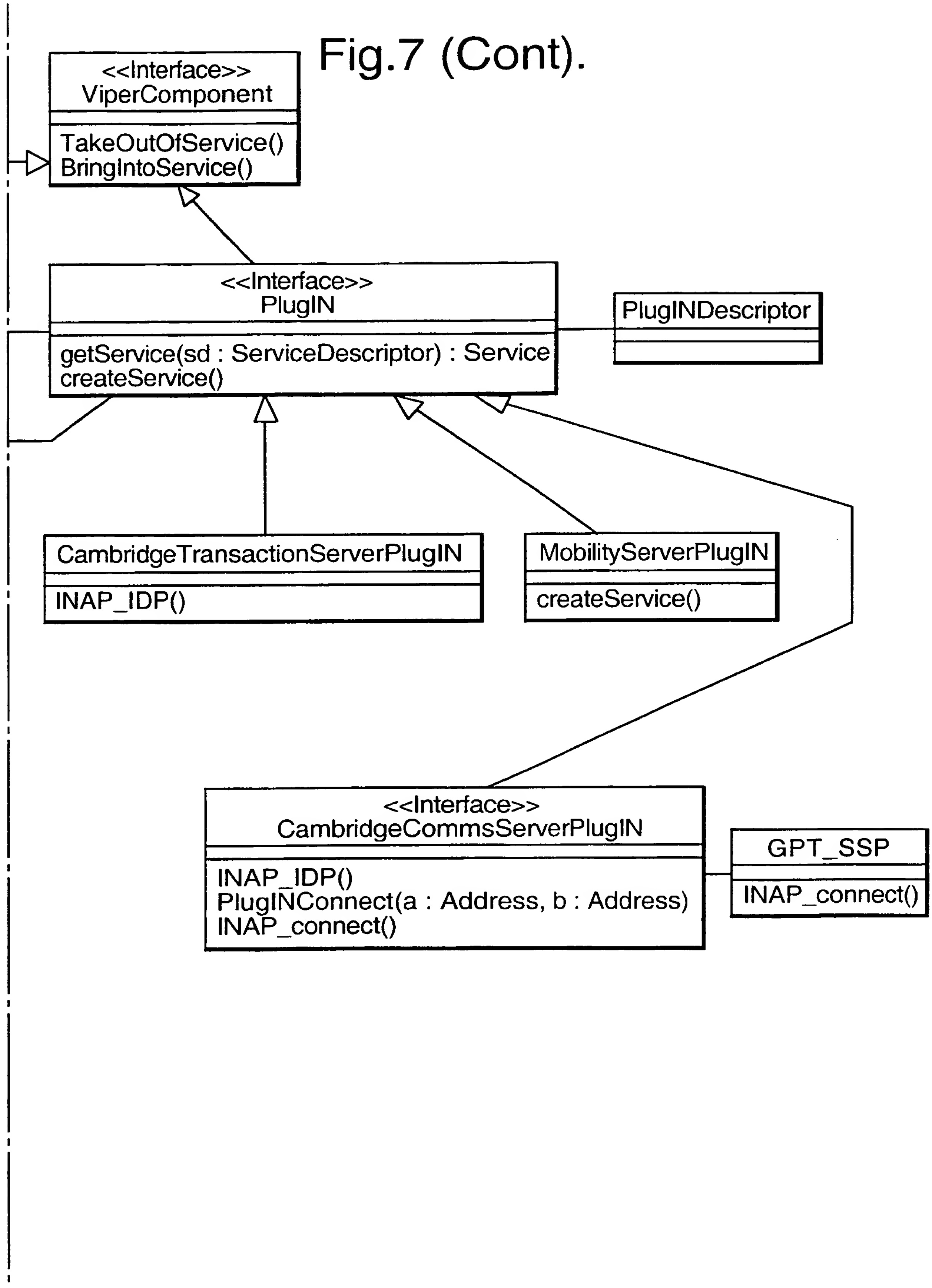
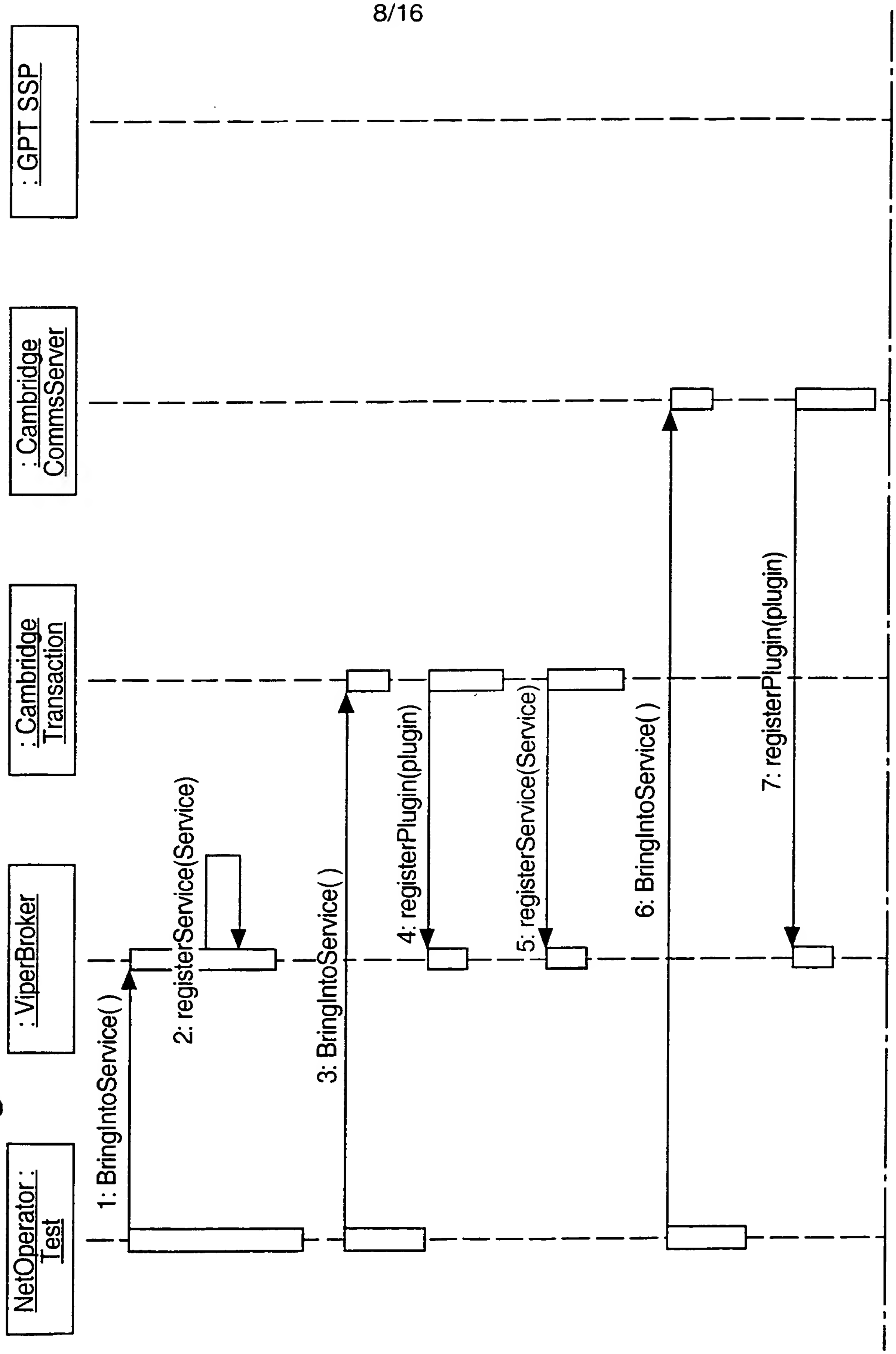

<<Interface>>
ViperComponent
TakeOutOfService()
BringIntoService()
<<Interface>>
PlugIN
getService(sd : ServiceDescriptor) : Service
createService()
PlugINDescriptor
CambridgeTransactionServerPlugIN
INAP_IDP()
MobilityServerPlugIN
createService()
<<Interface>>
CambridgeCommsServerPlugIN
INAP_IDP()
PlugINConnect(a : Address, b : Address)
INAP_connect()
GPT_SSP
INAP_connect()

Fig.8.


NetOperator : Test
: ViperBroker
: Cambridge Transaction
: Cambridge CommsServer
: GPT SSP
1: BringIntoService( )
2: registerService(Service)
3: BringIntoService( )
4: registerPlugin(plugin)
5: registerService(Service)
6: BringIntoService( )
7: registerPlugin(plugin)

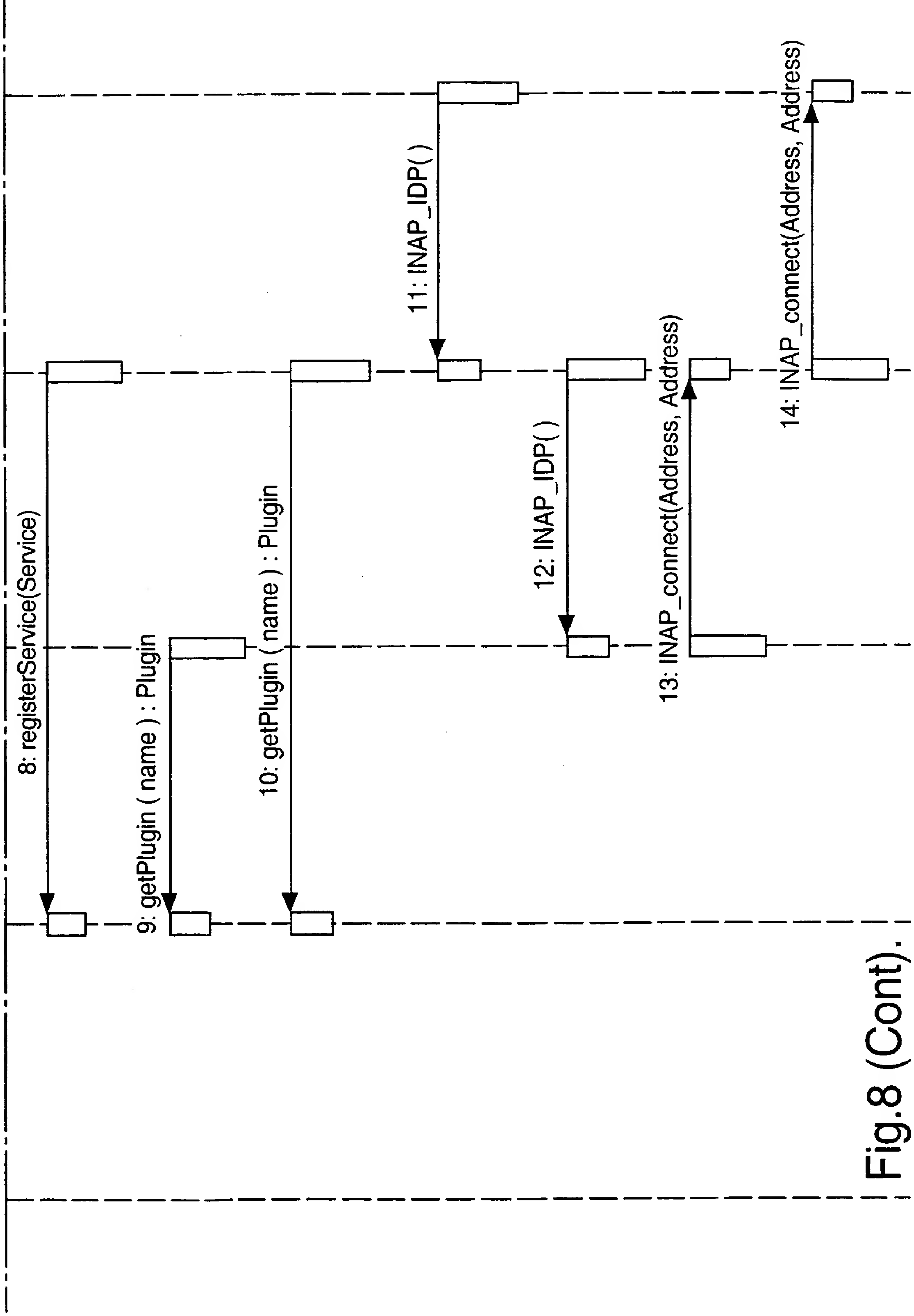
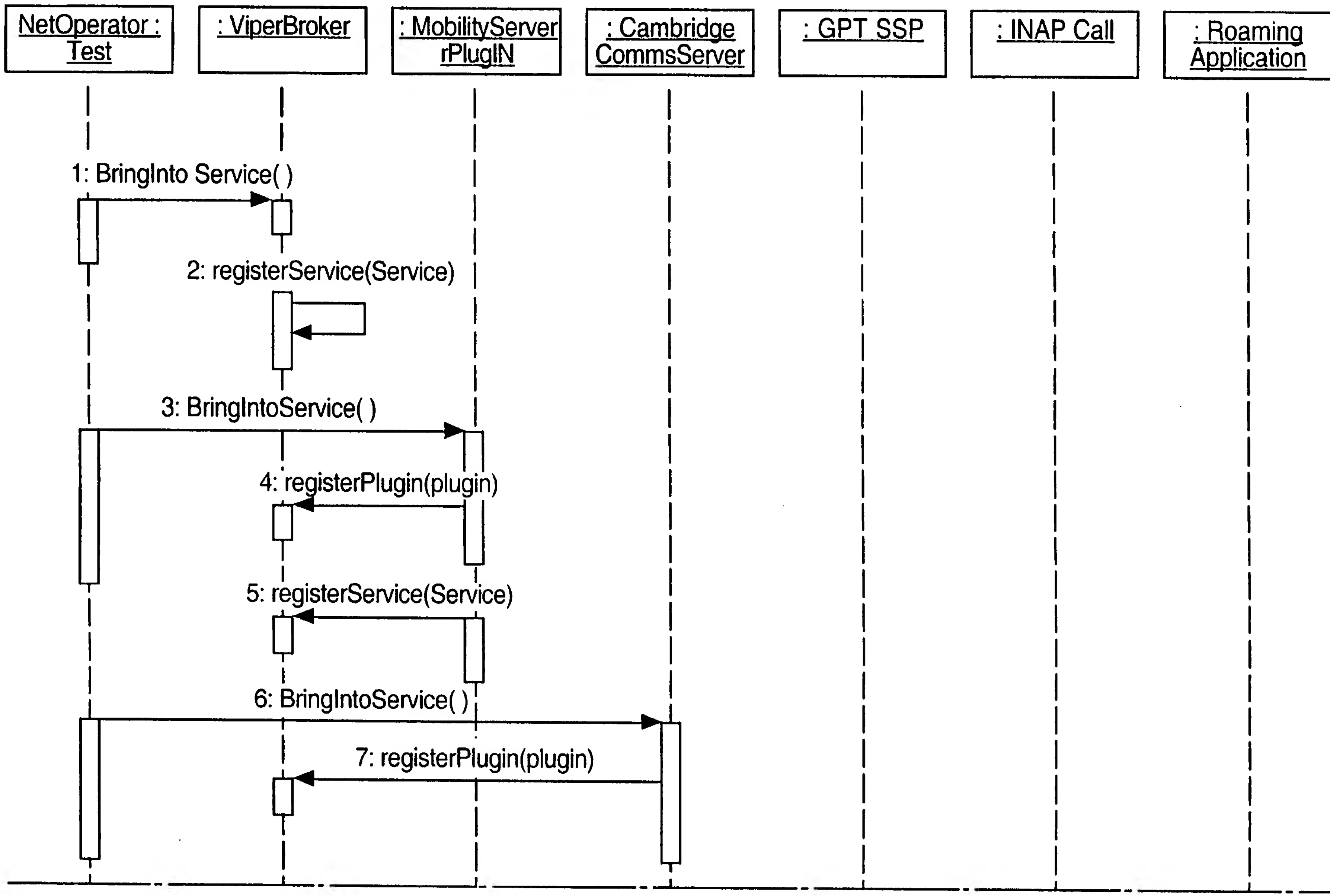

8: registerService(Service)
9: getPlugin (name) : Plugin
10: getPlugin (name) : Plugin
11: INAP_IDP( )
12: INAP_IDP( )
13: INAP_connect(Address, Address)
14: INAP_connect(Address, Address)

Fig.8 (Cont).

Fig.9.


NetOperator : Test
: ViperBroker
: MobilityServerrPlugIN
: Cambridge CommsServer
: GPT SSP
: INAP Call
: Roaming Application
1: BringInto Service( )
2: registerService(Service)
3: BringIntoService( )
4: registerPlugin(plugin)
5: registerService(Service)
6: BringIntoService( )
7: registerPlugin(plugin)

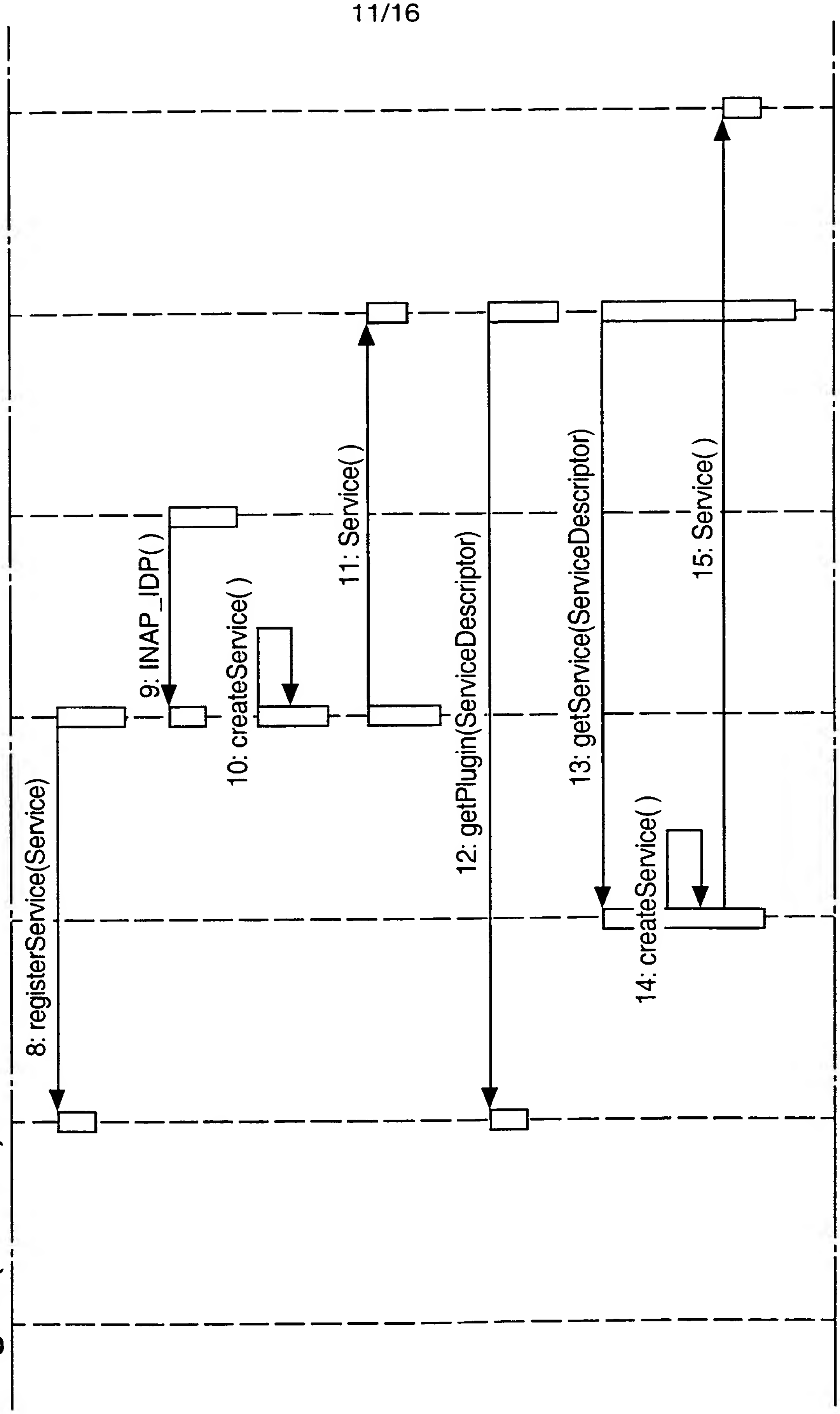

8: registerService(Service)
9: INAP_IDP( )
10: createService( )
11: Service( )
12: getPlugin(ServiceDescriptor)
13: getService(ServiceDescriptor)
14: createService( )
15: Service( )

Fig.9 (Cont i).

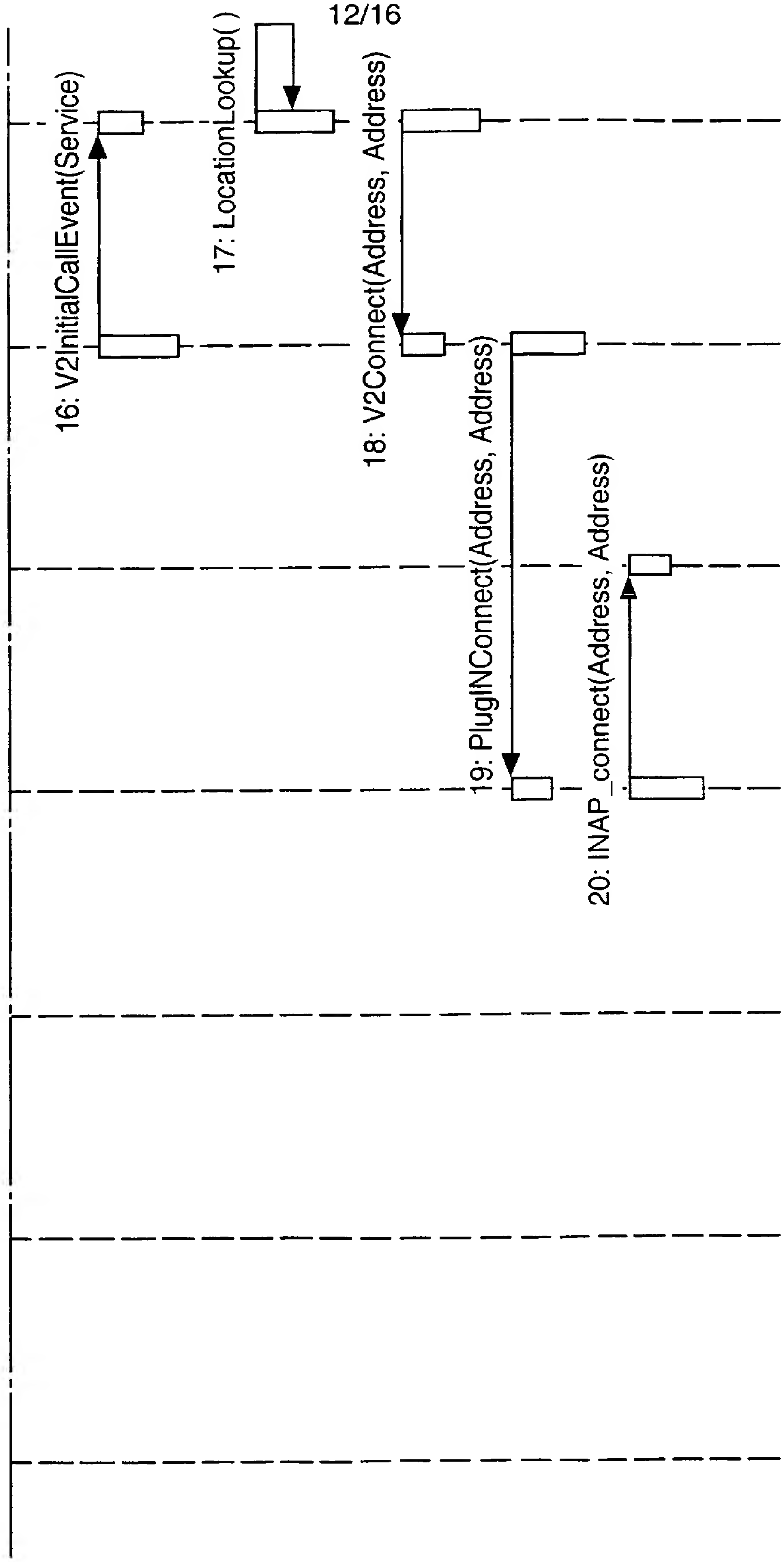

16: V2InitialCallEvent(Service)
17: LocationLookup( )
18: V2Connect(Address, Address)
19: PlugINConnect(Address, Address)
20: INAP_connect(Address, Address)

Fig.9 (Cont ii).

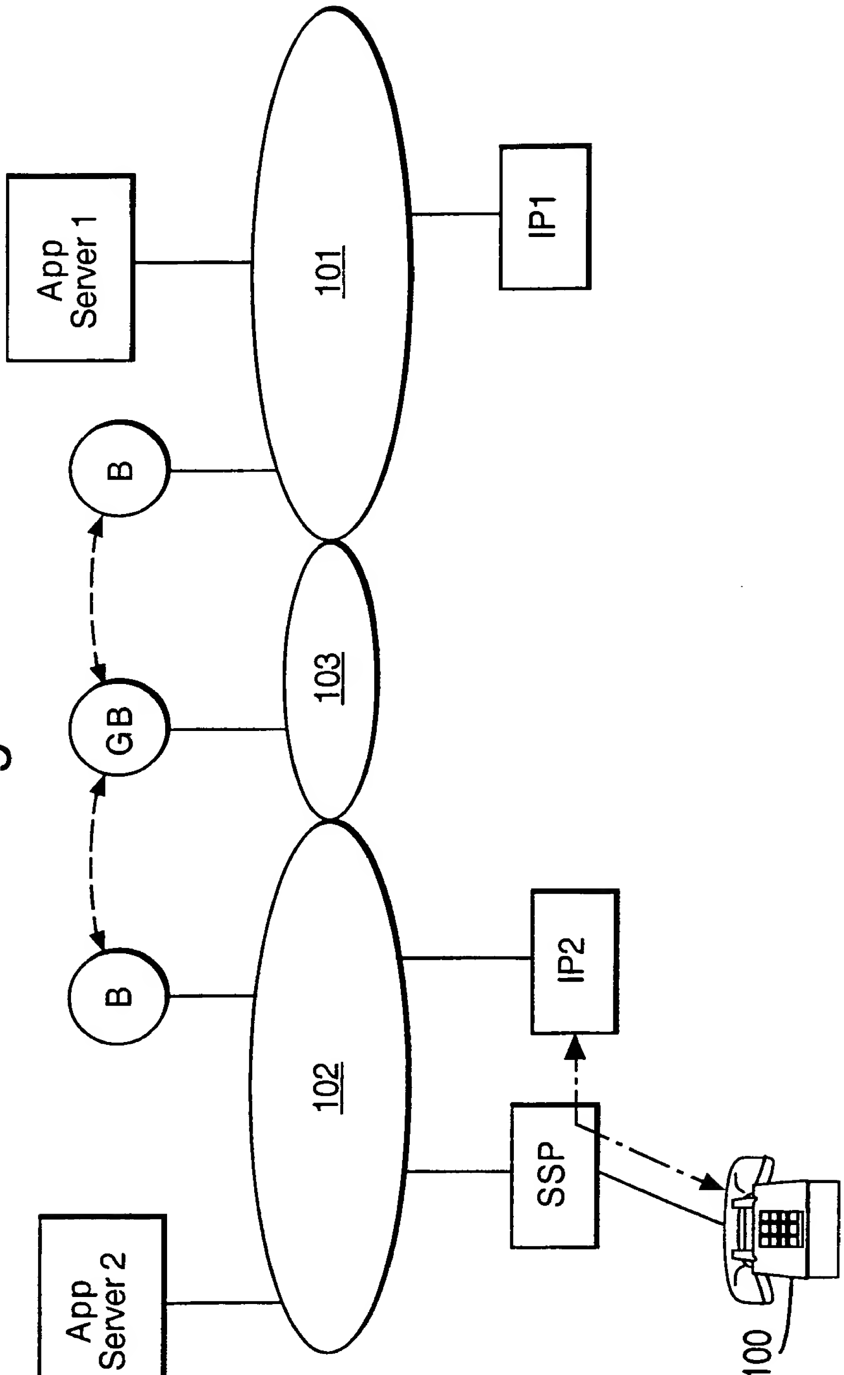


Fig.10.

Fig.11.

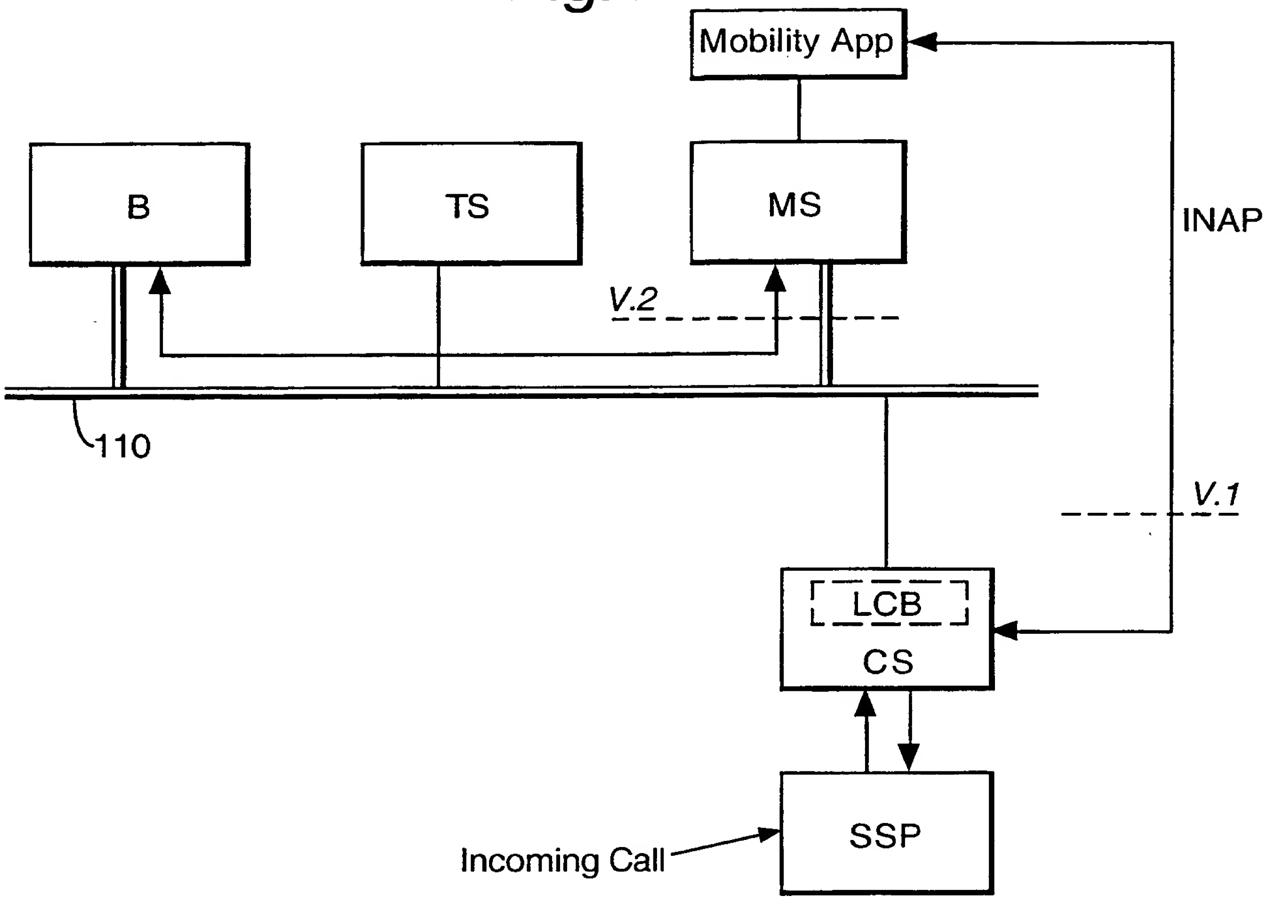

Mobility App
B
TS
MS
INAP
V.2
110
V.1
LCB
CS
SSP
Incoming Call

Fig.12.

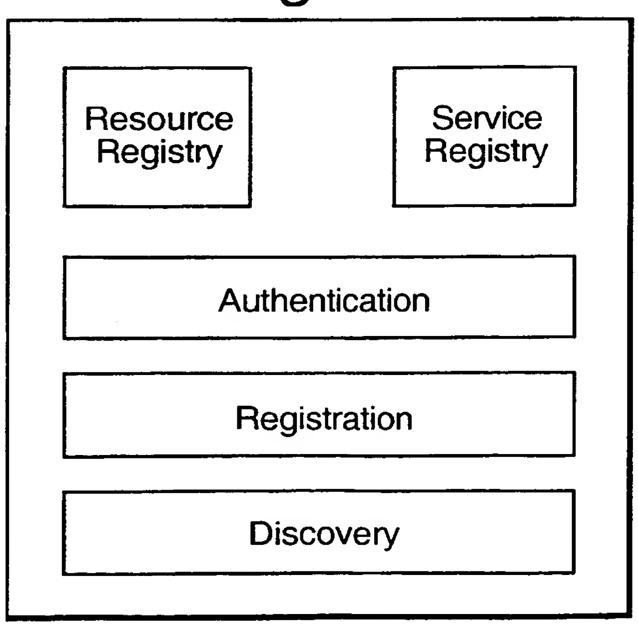

Resource Registry
Service Registry
Authentication
Registration
Discovery

Fig.13.

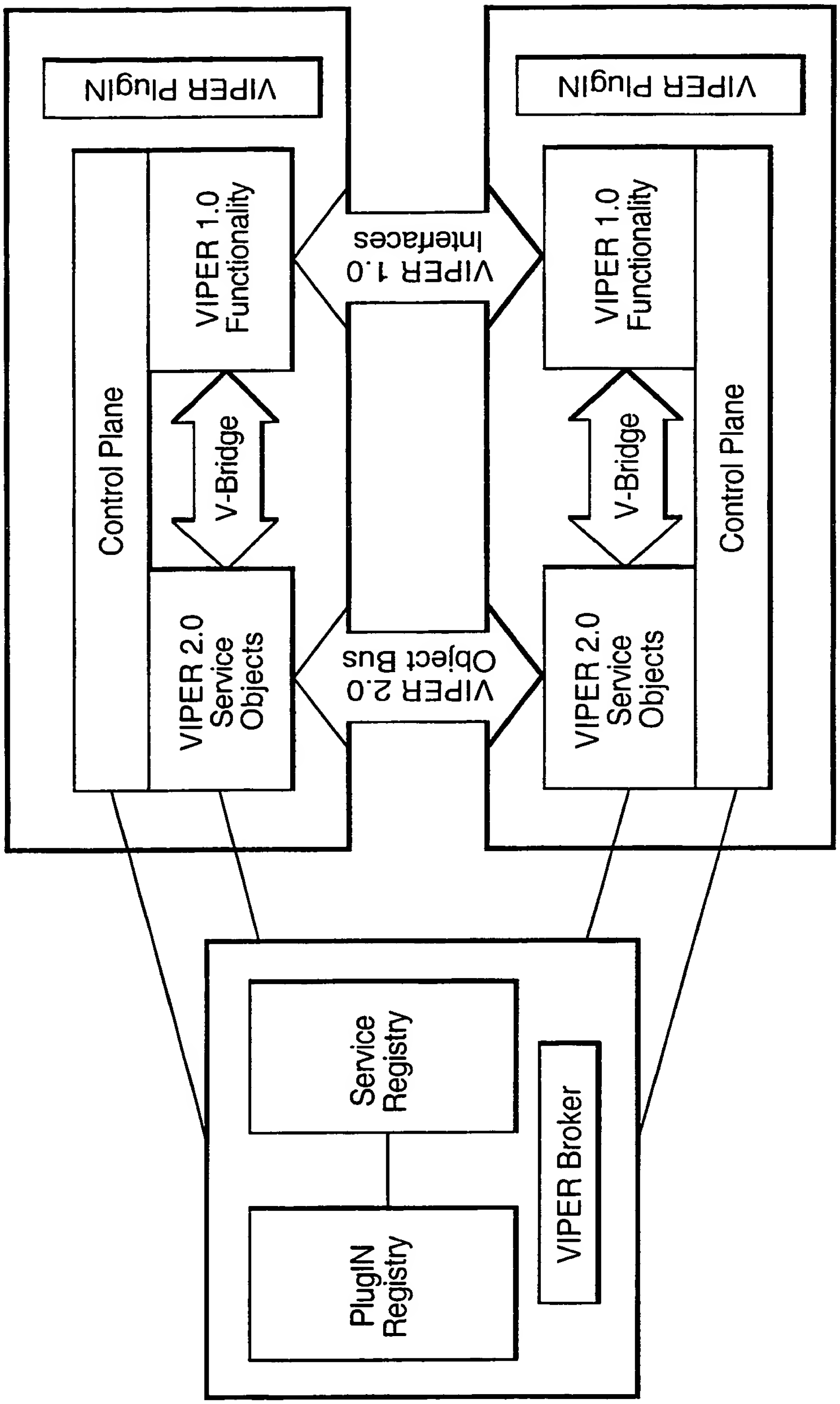
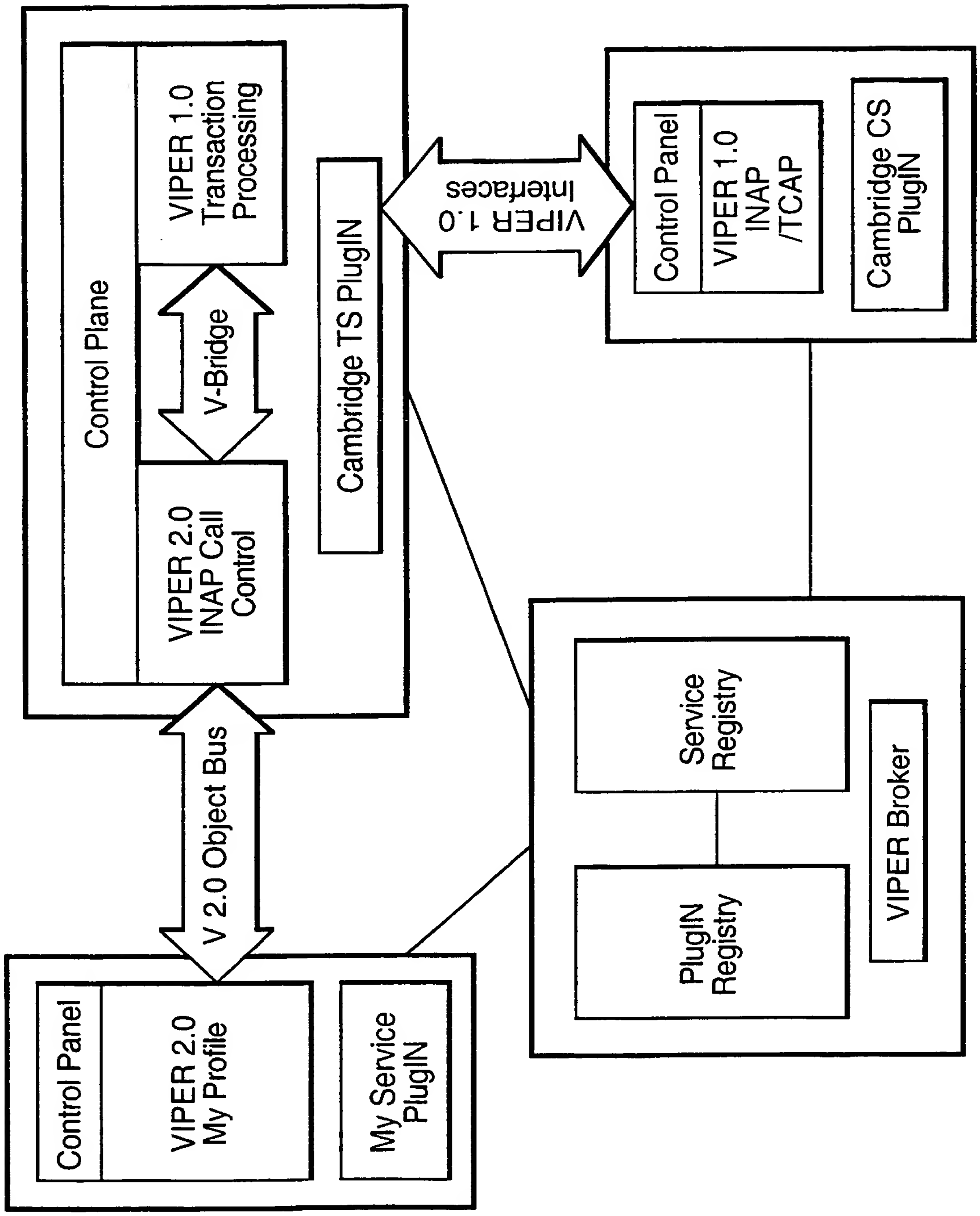

VIPER PlugIN
Control Plane
VIPER 1.0 Functionality
V-Bridge
VIPER 2.0 Service Objects
VIPER 1.0 Interfaces
VIPER 2.0 Object Bus
VIPER PlugIN
VIPER 1.0 Functionality
V-Bridge
Control Plane
VIPER 2.0 Service Objects
Service Registry
PlugIN Registry
VIPER Broker

Fig.14.


Control Plane
VIPER 1.0 Transaction Processing
V-Bridge
VIPER 2.0 INAP Call Control
Cambridge TS PlugIN
VIPER 1.0 Interfaces
Control Panel
VIPER 1.0 INAP /TCAP
Cambridge CS PlugIN
V 2.0 Object Bus
Service Registry
PlugIN Registry
VIPER Broker
Control Panel
VIPER 2.0 My Profile
My Service PlugIN

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 99/03347

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 96 42173 A (BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY) 27 December 1996 (1996-12-27) abstract page 1, line 28 -page 2, line 13 page 2, line 27 - line 32 page 3, line 27 - line 31 page 4, line 18 - line 32 page 7, line 1 -page 8, line 18 page 13, line 20 - line 32 --- -/--	1,2,10, 13,14

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 December 1999	12/01/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Larcinese, C

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onal Application No
PCT/GB 99/03347

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	WO 96 20448 A (SOUTHWESTERN BELL TECHNOLOGY RESOURCES, INC.) 4 July 1996 (1996-07-04) abstract page 10, line 36 -page 11, line 2 page 13, line 12 - line 29 page 18, line 5 - line 17 page 37, line 14 - line 25 page 43, line 24 -page 44, line 32 page 45, line 2 - line 36 -----	1-21

1

INTERNATIONAL SEARCH REPORT

mation on patent family members

onal Application No
PCT/GB 99/03347

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9642173 A	27-12-1996	AU 693373 B	25-06-1998
		AU 6009796 A	09-01-1997
		CA 2220069 A	27-12-1996
		CN 1185260 A	17-06-1998
		EP 0830791 A	25-03-1998
		JP 11507785 T	06-07-1999
		NO 975777 A	08-12-1997
		NZ 309840 A	27-04-1998
WO 9620448 A	04-07-1996	AU 4469896 A	19-07-1996